

REMARKS

Claims 1, 3-22 and 24-39 are pending in this application. Claims 33 – 39 have been withdrawn from consideration and claims 1, 3 – 22 and 24 – 32 are rejected in the present Office Action.

Claim 1 was rejected as unpatentable under 35 U.S.C. 103(a) by U.S. Patent No. 6,194,788, issued to Gilleo in view of Japanese Publication 58103525, published by Kunitomo. Kunitomo teaches the use of a phenol containing curing promoting agent. There is no reasonable expectation that the addition of the phenol containing curing promoting agent of Kunitomo would work in Gilleo's acid anhydride/carboxylic acid flux/hardener added encapsulant (column 6, lines 50-52). It is well known in the art that the combination of acidic compounds can prematurely cure the phenol resins (since 1930's Principles of Polymerization pg 109, last two lines). Thus, the addition of Kunitomo's phenol containing curing promoting agent to Gilleo's fluxing agent/hardener (acid anhydride or carboxylic acid) would result in prematurely cured encapsulant. The present invention requires the final curing to be delayed until after the solder has reflowed and made interconnections. Because the phenol containing curing promoting agent can be prematurely cured with the acidic fluxing agent/hardener, one would not look to combine Kunitomo's curing promoting agent to Gilleo's invention. Fluxing and solder interconnection cannot be performed at solder reflow temperature if the system prematurely cures. Thus, it is surprising that this invention can delay the curing instead of accelerating it when the phenol containing compound is used in conjunction with anhydride-imidazole adduct. Due to the delay, the present invention can allow the solder to reflow and make good interconnection during the final cure. Accordingly, it is respectfully submitted that claim 1 is patentable under 35 U.S.C. 103(a) over Gilleo in view of Kunitomo.

B-staging is a separate and distinct process than final curing. As used in the present invention, B-stage is when a paste is applied to the wafer and then heated to a temperature of at least 30°C less than the final cure temperature to prevent curing of the material (page 6, lines 18-23). The result is the formation of a smooth, non-tacky surface which can be cleanly diced into individual chips (page 6, lines 8-9). The individual chip with the B-staged underfill can then undergo the final cure which will solidify the underfill onto the substrate while not interfere with the formation of the solder interconnection (page 4, lines 14-19). The final cure occurs a second temperature that is higher than B-stage curing temperature (page 6, lines 11-13). Thus, the catalyst chosen for this invention must prevent any curing, other than some minimal pre-curing during the B-stage, yet allow the B-staged underfill to cure after the solder bump flow and interconnect onto the substrate (page 6, lines 18-21; page 4, lines 14-15). If the material becomes prematurely cured during the B-stage it will not be able to flow and solder interconnection will not be made during the final cure. Hence choosing the proper curing agent that will prevent premature curing at temperatures below the solder reflow temperature is critical to this invention. The addition of Kunitomo's phenol containing resin to Gilleo's

patent would result in a prematurely cured encapsulant. Thus, one skilled in the art would not be led to combine these patents, because delayed final curing is desired for this invention. Accordingly, it is respectfully submitted that claims 1 is patentable under 35 U.S.C. 103(a) over Gilleo in view of Kunitomo.

Claims 3 – 22 and 24-31 were rejected as unpatentable under 35 U.S.C. 103(a) over Gilleo in view of Kunitomo and further in view of JP 62-081416A, issued to Kobayashi. The distinctions between Gilleo, Kunitomo and the present invention set forth above are equally applicable to the present rejection. The Examiner has noted the use of the composition of Kobayashi in the invention of Gilleo and Kunitomo because Kobayashi is relied upon to teach the conventionality of the component. Both Kunitomo and Kobayashi teach about accelerating the cure speed for molding processes, but neither teach that their material can be utilized in wafer level assembly because they cannot be B-staged, diced, fluxed, and latently cured. Kunitomo teaches that the use of phenol novolac resin with 2-methylimidazole/pyromellitic anhydride complex accelerates the curing speed, and hence the molding cycle is shortened (page 7 lines 1-4). Kobayashi teaches that reliability can be improved by adding a cure accelerator, 1, 8-diazabicyclo (5,4,0)-7-undecene and triorganophosphine, to phenolic curing agent (Abstract). One skilled in the art would not look to these references to delay the final curing until the solder reflow temperature because they indicate that the addition of phenolic and the adduct would result in acceleration of the cure. Hence it is surprising that the effect of the fluxing agent, phenolic containing compound, and the anhydride-imidazole adduct can allow for proper B-staging of the material from prematurely curing and allow the final cure to occur after the solder interconnection. When the epoxy, phenolic, and the anhydride-imidazole adduct is added without the flux, the enthalpy of the curing is about half the amount than material with the fluxing agent (Table 3, Example D3 and Table 4, Example E2). The enthalpy of the curing value is inversely proportional to premature curing during the B-stage process. The smaller the enthalpy of the curing value indicates that the material has premature curing during the B-stage process. Hence, the material without the flux indicates that some premature curing has occurred during the D3 B-stage, while the curing was retarded for the material with the flux at the E2 B-stage. Hence, the combination of the fluxing agent with the anhydride-imidazole, phenol, and epoxy has the effect of retarding the solidification of the coating during the B-stage process (page 20, lines 9-10). Accordingly, it is respectfully submitted that claims 3 – 22 and 24-31 are patentable under 35 U.S.C. 103(a) over Gilleo in view of Kunitomo and further in view of Kobayashi.

In view of the foregoing, it is respectfully submitted that the present application is in condition for allowance. If there are any issues that the Examiner wishes to discuss, he is invited to contact the undersigned attorney at the telephone number set forth below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Charles W. Almer', written in a cursive style.

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